

## Epidemiological Study of Allergic Conjunctivitis in a tertiary Eye Care Centre in North India

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### Abstract

**Purpose:** To study socio-demographic profile, clinical presentation and management, drug compliance and side effects in patients with Allergic Conjunctivitis at a tertiary Eye centre in Department of Ophthalmology, Government Medical College, Patiala.

**Methods:** In a prospective single centre study, 250 patients of AC fulfilling inclusion and exclusion criteria were enrolled after taking written informed consent. Their proper history was taken and clinical examination was done. Follow-up was done on 3<sup>rd</sup> day, 7<sup>th</sup> day, 14<sup>th</sup> day and subsequently at 1 month, 3 months and 6 months duration.

**Results:** SAC (52.4%) was the most common type of AC, followed by PAC (28.8%), VKC (11.6%), GPC (3.2%), AKC (2.8%) and CABC (1.2%). AC mostly affected young population, with females (61.2%) more in number than males. Itching (92.5%) was the most common symptom of AC, followed by watery eye (78.8%), frequent eye rubbing (74.4%), redness (72.4%). About half (49.2%) of patients had exacerbations in spring and summer seasons. 49(19.6%) patients had associated atopic condition; and 123 (49.2%) patients had a precipitating factor. 203 (81.2%) patients received more than one drug in treatment. Some cases of complications of AC were encountered like corneal abrasions (9.6%), amblyopia (2%) and secondary keratoconus (2.4%).

**Conclusion:** An understanding of epidemiology of allergic conjunctivitis is essential as it involves certain modifiable and treatable environmental conditions. It can impair quality of life to varying degrees and some cases may require multidisciplinary approach for management.

**Keywords:** Allergic Conjunctivitis; Seasonal Allergic Conjunctivitis; Perennial Allergic Conjunctivitis; Vernal Keratoconjunctivitis

### Introduction

Allergic Conjunctivitis (AC) is the inflammatory response of the conjunctiva to allergens like pollen, animal fur and other

environmental antigens [1]. Patients complain of itching, redness, watery eye, ropy discharge and frequent eye rubbing. It can result in decreased quality of life as patients may become school dropouts, unable to work outdoors and sometimes fail to sleep [2].

In sensitized individuals, Th2 cells release pro-inflammatory cytokines that stimulate production of immunoglobulin E (IgE) by the B cells. The IgE become bound to membrane of mast cells and subsequent cross-linking by their respective allergens triggers mast cell degranulation resulting in release of mediators (histamine, prostaglandins) [3].

Ocular allergic diseases are classified into six categories: Seasonal allergic conjunctivitis (SAC), Perennial allergic conjunctivitis (PAC), Vernal Keratoconjunctivitis (VKC), Atopic Keratoconjunctivitis (AKC), Giant papillary conjunctivitis (GPC) and Contact allergic blepharoconjunctivitis (CABC).

SAC and PAC are the most common forms of AC. SAC is usually caused by airborne pollens in spring and summer. PAC can occur throughout the year with exposure to perennial allergens [4].

VKC is a disease of warm climates and occurs mostly in young males [5]. Three clinical forms of VKC are there: limbal or bulbar, palpebral and mixed. The limbal form may present as gelatinous thickening with papillae at the limbus and Horner-Tranta's dots. The hallmark of the palpebral VKC is presence of giant papillae having a cobble stone appearance. The mixed form of VKC has features of both limbal and palpebral VKC.

AKC is a bilateral disease of ocular surface and it occurs throughout life [4]. GPC occurs due to the presence of external substances like contact lens, ocular prosthesis or sutures, which may sensitise and cause trauma to the upper tarsal conjunctiva with the formation of giant papillae. In Contact allergic blepharoconjunctivitis, the pattern of involvement depends upon severity of the reaction and the sites of contact.

Complications like corneal scar, shield ulcer, limbal stem cell deficiency (LSCD), secondary keratoconus, steroid-induced glaucoma may be there because of poor compliance to treatment by the patient or inadequate control of the disease [6].

The diagnosis of AC is made from the patient examination, reported symptoms as well as personal and familial past allergic history. Assessment of patients must include gross visual examination, refraction, slit-lamp biomicroscopy of the periocular and ocular tissues.

Optimal management of AC includes a broad approach that involves allergen avoidance, symptomatic relief and pharmacologic suppression of inflammatory responses [7]. Topical dual-activity agents provide benefits of two classes of drugs: immediate relief of antihistamines with prophylactic benefit of mast cell stabilizers. Steroids treat AC by reducing inflammatory cytokine production, mast cell proliferation and cell mediated immune responses. NSAIDs inhibit production of prostaglandins by blocking the cyclooxygenase pathway. Vasoconstrictors are  $\alpha$ -adrenergic agonists that relieve reddening caused by conjunctival vasodilation [8]. Immunomodulatory agents inhibit T-cell activation and show encouraging results in cases refractory to traditional treatment [9].

Hence; the present study was conducted for understanding the epidemiology of Allergic Conjunctivitis in patients presenting to a tertiary care centre in North India.

## Material and Methods

This was a prospective study conducted on 250 cases of AC attending the OPD of Department of Ophthalmology in Government Medical College, Patiala, Punjab.

Patients fulfilling inclusion criteria and having none of exclusion criteria were enrolled in the study after obtaining written informed consent.

### Inclusion criteria included

- One or more symptoms of the following-itching, redness, watery eye, ropy discharge, frequent eye rubbing.
- Patient who gave consent for the study.

### Exclusion criteria included

- Drug induced AC like drugs with anti-cholinergic properties, anti-glaucoma drugs
- Dry eye
- Any infectious cause like Herpes Simplex Virus, Bacterial Conjunctivitis
- Blepharitis

### Study eye

One or more eye(s) with one or more symptoms of itching, redness, watering eye, ropy discharge, frequent eye rubbing was included in the study.

**Study design and size**

This was prospective study conducted on 250 patients of AC fulfilling inclusion criteria either in one eye or both eyes. A proper history was taken and clinical examination was done, which was entered in proforma.

**Symptoms included in the study were as follows-**

- Itching
- Redness
- Watery eye
- Ropy discharge
- Frequent eye rubbing

**Signs included in the study were as follows-**

- Redness
- Lacrimation
- Papillary hyperplasia of tarsal conjunctiva
- Lid swelling
- Discoloration of conjunctiva
- Secondary changes in cornea like vascularization.

**Examination of the patient**

Complete ocular examination was done which included refraction, slit lamp biomicroscopy. Record was maintained of photographs taken by slit lamp biomicroscope on Day 0, Day 3, Day 7, Day 14 and subsequently at 1 month, 3 months and 6 months duration.

**Classification of various types of AC was done as follows-**

- Seasonal allergic conjunctivitis (SAC)
- Perennial allergic conjunctivitis (PAC)
- Vernal keratoconjunctivitis (VKC)
- Atopic keratoconjunctivitis (AKC)
- Giant papillary conjunctivitis (GPC)
- Contact Allergic Blepharoconjunctivitis (CABC).

**Grading of Vernal keratoconjunctivitis was done as follows**

Treatment was started and the first dose of medication was instilled in OPD under medical supervision.

	Mild	Moderate	Severe	Blinding
Bulbar conjunctiva	Congestion	Congestion	Thickening Horner-Tranta's dots	Granulomas
Tarsal conjunctiva	Micropapillae	Macro (<1 mm) papillae	Giant (>1 mm) papilla	Mega cobblestones
Cornea	-	Microerosions	Macroerosions	Shield ulcer
Limbus	-	Focal (<1800) inflammation	Diffuse (>1800) inflammation	Limbal deficiency

**Table a**

**Statistical analysis**

Descriptive statistics was done for all data collected from 250 patients and were reported in terms of number and percentages. Appropriated statistical tests of comparison were applied. Categorical variables were analyzed with the help of chi square test. Statistical Significance was taken as p< 0.05. The data was analyzed using Microsoft Excel and SPSS version 22.

**Results and Observations**

The study enrolled 250 patients, amongst them 153 (61.2%) were females. Most common type of allergic conjunctivitis was SAC, present in 131 (52.4%) patients, followed by PAC, VKC, GPC, AKC and CABC diagnosed in 72 (28.8%), 29 (11.6%), 8 (3.2%), 7 (2.8%) and 3 (1.2%) patients respectively. The mean age (±SD) of study population was 28.31 ± 14.86 years. Number of patients in three age groups i.e. ≤ 15 years, 16- 45 years and ≥ 46 years were 79 (31.6%), 132 (52.8%) and 39 (15.6%) respectively. Our study included 118 (47.2%) students, 45 (18%) businessmen, 24 (9.6%) farmers, 20 (8%) teachers and 43 (17.2%) others, which were not included in these occupations. 85 (34%) patients were educated upto 10<sup>th</sup> standard, 31 (12.4%) upto +2 standard and 134 (53.6%) were graduates. More than half, 155 (62%) patients were from urban areas and 95 (38%) were from rural areas.

Variables	SAC n (%) 131(52.4%)	PAC n (%) 72(28.8%)	VKC n (%) 29(11.6%)	GPC n (%) 8(3.2%)	AKC n (%) 7(2.8%)	CABC n (%) 3(1.2%)
AGE (years)						
≤ 15	40(30.5%)	11(15.3%)	27(93.1%)	-	-	1(33.3%)
16-45	73(55.7%)	46(63.9%)	2(6.9%)	5(62.5%)	4(57.1%)	2(66.7%)
≥ 46	18(13.7%)	15(20.8%)	-	3(37.5%)	3(42.9%)	-
(p value)	(<0.001)	(<0.001)	(<0.001)	(0.437)	(0.998)	(0.998)
GENDER						
Male	46(35.1%)	23(31.9%)	20(69.0%)	4(50.0%)	3(42.9%)	1(33.3%)
Female	85(64.9%)	49(68.1%)	9(31.0%)	4(50.0%)	4(57.1%)	2(66.7%)
(p value)	(<0.001)	(0.002)	(0.041)	-	(0.998)	(0.998)
Education						
Upto 10 <sup>th</sup>	45(34.4%)	12(16.7%)	27(93.1%)	-	-	1(33.3%)
+2	16(12.3%)	14(19.4%)	-	-	1(14.3%)	-
Graduation and above	70(53.4%)	46(63.9%)	2(6.9%)	8(100%)	6(85.7%)	2(66.7%)
Occupation						
Student	61(46.6%)	23(31.9%)	27(93.1%)	3(37.5%)	2(28.5%)	2(66.7%)
Businessmen	29(22.1%)	12(16.7%)	-	2(25.0%)	2(28.5%)	-
Teacher	14(10.7%)	5(6.9%)	-	1(12.5%)	-	-
Farmer	11(8.4%)	13(18.1%)	-	-	-	-
Others	16(12.2%)	19(26.4%)	2(6.9%)	2(25.0%)	3(42.8%)	1(33.1%)
Residence						
Urban	78(59.5%)	48(66.7%)	18(62.1%)	5(63.5%)	4(57.1%)	2(66.7%)
Rural	53(40.5%)	24(33.3%)	11(37.9%)	3(37.5)	3(37.5%)	1(33.3%)
(p value)	(0.029)	(0.005)	(0.194)	(0.480)	(0.705)	(0.564)
Previously treated (P) or fresh case(F)						
P	40(30.5%)	21(29.2%)	10(34.5%)	-	1(14.3%)	-
F	91(69.5%)	51(70.8%)	19(65.5%)	8(100%)	6(85.7%)	3(100%)
(p value)	(<0.001)	(<0.001)	(0.095)	-	(0.059)	-
Duration of symptoms						
≤ 4 weeks	105(80.2%)	38(52.8%)	24(82.8%)	5(62.5%)	5(71.4%)	2(66.6%)
>4 weeks	26(19.8%)	34(47.2%)	5(17.2%)	3(37.5%)	2(28.6%)	1(33.3%)
(p value)	(<0.001)	(0.637)	(<0.001)	(0.480)	(0.257)	(0.564)

**Table 1:** Demographic profile of patients.

p-value &lt;0.05 is taken as significant.

	Dust		Sunlight		Pollen		Smoke		Dandruff		Cosmetics		Chi Square	p value
	N	%	N	%	N	%	N	%	N	%	N	%		
SAC	30	22.9	14	10.7	13	9.9	10	7.6	1	0.8	-	0.0	32.441	<0.001
PAC	26	36.1	8	11.1	-	0.0	5	6.9	1	1.4	2	2.8	49.667	<0.001
VKC	2	6.9	5	17.2	-	0.0	-	0.0	-	0.0	-	0.0	1.286	0.257
AKC	-	0.0	2	28.6	-	0.0	-	0.0	-	0.0	2	28.6	-	-
GPC	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	-
CABC	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	2	66.7	-	-
Total out of 250)	58	23.2	29	11.6	13	5.2	15	6.0	2	0.8	6	2.4		

**Table 2:** Precipitating Factors.

p-value <0.05 is taken as significant.

Table 2 shows precipitating factors leading to symptoms of AC, as reported by patients.

Allergic rhinitis, asthma and dermatitis were reported as associated atopic conditions in 87.8 (17.2%), 3 (1.2%) and 3 (1.2%) patients respectively. About one-fifth of the patients (n = 46, 18.4%) reported AC as cause of irritation to them. Loss of work and decreased concentration were reported by 24 (9.6%) and 23(9.2%) patients respectively.

206 (82.4%) patients had uncorrected visual acuity as 6/6 on Snellen’s chart. Among 44 (17.6%) patients who had VA < 6/6 on Snellen’s chart, 31 were myopes, 12 were hypermetropes and 33 had astigmatism.

In our study, 178(71.2%) were freshly reported cases and 72 ( 28.8%) had taken some treatment previously. Itching was the most common symptoms reported by 92.5% patients, followed by watery eye (78.8%), frequent eye rubbing (74.4%), redness (72.4%) and ropy discharge (21.2%).

	Itching (n)	Redness (n)	Watery Eye (n)	Ropy Discharge (n)	Frequently Eye Rubbing (n)
SAC	125	93	90	27	121
PAC	68	51	73	12	34
VKC	25	24	21	10	23
AKC	6	5	5	2	3
GPC	6	6	5	2	4
CABC	1	2	3	0	1
Total	231	181	197	53	186
Percentage (%) (out of 250)	92.5	72.4	78.8	21.2	74.4

**Table 3:** Symptoms.

	Loss of work		Irritability		Decreased Concentration		Chi Square	p value
	Number	%	Number	%	Number	%		
SAC	12	26.1	26	56.5	8	17.4	11.652	0.003
PAC	5	20.0	12	48.0	8	32.0	2.960	0.228
VKC	5	33.3	4	26.7	6	40.0	0.400	0.819
AKC	1	33.3	2	66.7	0	0.0	0.333	0.564
GPC	1	33.3	1	33.3	1	33.3	-	-
CABC	0	0.0	1	100.0	0	0.0	-	-
Total (%-out of 250)	24	25.8	46	49.5	23	24.7		

**Table 4:** Effect on Quality of life.

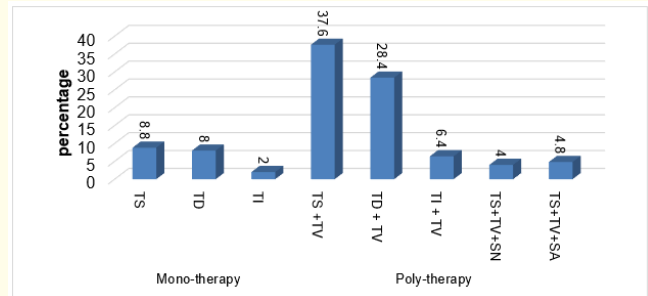
p-value <0.05 is taken as significant.

	Number	Percentage (out of 250)
Conjunctival Hyperaemia	222	88.8
Papillae	206	82.4
Lacrimation	180	72
Follicles	49	19.6
Swollen Eyelids	29	11.6
Corneal Abrasions	24	9.6
Concretions	17	6.8
Perilimbal Pigmentation	10	4
Horner Tranta’s Dots	8	3.2
Secondary Keratoconus	6	2.4
Pseudogerontoxon	3	1.2

**Table 5:** Signs.

As shown in Table 5, conjunctival hyperaemia, tarsal conjunctival papillae and follicles were present in 222(88.8%), 206(82.4%) and 49 (19.6%) patients respectively. Lacrimation and swollen eyelids were found in 180 (72%) and 29 (11.6%) patients. Perilimbal pigmentation, Horner Tarnta’s dots and pseudogerontoxaon were found in 10(4%), 8(3.2%) and 3(1.2%) patients. Concretions were found as sign in 17(6.8%) patients. Among 24 VKC patients with

tarsal conjunctival papillae, palpebral limbal and mixed papillae were found in 18, 2 and 4 patients. In our study, out of 29 cases of VKC, 5 (17.2%) were mild, 9 (31.1%) were moderate, 13 (44.8%) were severe and 2 (6.9%) were blinding as per VKC grading.



**Graph 1:** Treatment given to patients.

(TS - Topical Steroid, TD - Topical Dual-Acting Agents, TI - Topical Immunomodulators, SA - Systemic Antihistaminics, SN - Systemic NSAIDs, TN - Topical NSAIDs, TV - Topical Vasoconstrictors).

	Mono-therapy (n = 47)		Poly-therapy (n= 203)		Chi Square	P value
	Number	Percentage	Number	Percentage		
Day 3	0	0.0	0	0.0	-	-
Day 7	2	4.3	7	3.5	0.069	0.792
Day 14	17	39.5	38	21.6	5.916	0.015
1 Month	25	67.6	60	48.4	4.207	0.040
3 Month	16	61.5	50	64.1	0.055	0.814
6 Month	7	63.6	29	76.3	0.704	0.402

**Table 6:** Improvement In signs.

p-value <0.05 is taken as significant.

	Mono-therapy (n = 47)		Poly-therapy (n = 203)		Total	
	Number	Percentage	Number	Percentage	Number	Percentage (out of 250)
Day 3	47	100.0	202	99.5	249	99.6
Day 7	46	97.9	198	97.5	244	97.6
Day 14	43	91.5	176	86.7	219	87.6
1 Month	37	78.7	124	61.1	161	64.4
3 Month	26	55.3	78	38.4	104	41.6
6 Month	11	23.4	38	18.7	49	19.6

**Table 7:** Compliance shown by patients.

In present study, 47 (18.8%) patients of AC received monotherapy, i.e. one drug in treatment. Among these patients, topical steroids (TS), topical dual-acting agents (TD) and topical immunomodulators (TI) were given to 22 (46.8%), 20 (42.5%), and 5 (10.6%) patients respectively.

203 (81.2%) patients received polytherapy i.e. more than one drug in treatment. Among these patients, 94 (46.3%) patients were prescribed TS + TV, 71 (35%) were prescribed TD + TV, 16 (7.9%) were prescribed TI + TV, 10 (4.9%) were prescribed TS + TV + SN, 12 (5.9%) were prescribed TS + TV + SA.

Among the patients who received monotherapy, improvement in signs was observed in 2 (4.3%), 17 (39.5%), 25 (53.2%), 16 (61.5%) and 7 (27.3%) patients on 7<sup>th</sup> day, 14<sup>th</sup> day, 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month visit respectively.

Among the patients who received polytherapy, improvement in signs was observed in 7 (3.5%), 38 (21.6%), 60 (48.4%), 50 (64.1%) and 29 (76.3%) patients on 7<sup>th</sup> day, 14<sup>th</sup> day, 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month visit respectively. These percentages were out of the study participants who visited OPD on the respective days.

Compliance shown by patients was 99.6%, 97.6%, 87.6%, 64.4%, 41.6% and 19.6% on 3<sup>rd</sup> day, 7<sup>th</sup> day, 14<sup>th</sup> day, 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month visit respectively. The patients who did not attend follow-up visits were called telephonically to know reason for non-compliance. 107 (42.8%) reported lack of symptoms, 24 (9.6%) reported distance, 21 (8.4%) reported cost of therapy, 17 (6.8%) told covid-19 restrictions, 12 told duration of therapy as reason for non-attendance.

There were some side-effects of drugs prescribed, like burning sensation of eye (5.6%), transiently raised intraocular pressure (3.6%) and rebound hyperaemia (1.6%). Some cases of complications of AC were encountered like corneal abrasions (9.6%), secondary keratoconus (2.4%), amblyopia (2%) and limbal stem cell deficiency (0.4%).

## Discussion

In our study, largest proportion of study participants were diagnosed as SAC, followed by PAC, VKC, GPC, AKC, CABC types of allergic conjunctivitis. Similar trends in prevalence were seen in

studies conducted by Uchio E., *et al.* [10] and Leonardi., *et al.* [11], In this part of world, there is tropical climate, so beginning of spring and summer season has marked effect on weather conditions. This leads to increase in pollen in air, which along with stubble burning as agricultural practice, makes SAC as the most common type of AC here. With increasing air pollution which includes vehicular and industrial exhausts, PAC is the second most common type of AC found here, prevalence of which is expected to increase in coming times.

Mean age of all study participants was  $28.31 \pm 14.86$  years. SAC and PAC were significantly more prevalent in 16-45 years age group and VKC was significantly more common below 15 years of age. This is in concordance with studies conducted by Kausar A., *et al.* [12] and Leonardi P., *et al.* [11]. Thus it can be inferred that AC is a disease mainly affecting young population and it interferes with their daily routine works in varying severity.

SAC and PAC were significantly more common in females and VKC was significantly more common in males. Similar findings were noticed in studies by Geraldini M., *et al.* [13], and Kausar., *et al.* [14]. Since the genetic composition of females is different from males, it may be the cause of the predisposition females to AC. Also, males were found to be worse culprits regarding non-attendance.

In our study, students formed the greatest proportion of cases among SAC, PAC and VKC patients. It is because AC is a disease of young population, which comprised of mostly students. Businessmen are usually found in the market places, here they are continuously exposed to dust from the environment and exhaust fumes from vehicles. Some teachers have to travel daily for long distances and are exposed to dust and environmental pollutants.

Among all types of AC, significantly more number of patients belonged to urban areas than rural areas in SAC and PAC. Similar results were given by studies by Patel., *et al.* [15] and Jalbert I., *et al.* [16]. The causes of urban-rural area disparity in our study may be that firstly, our hospital is situated in a city, so more patients from nearby areas are expected to visit OPD. Secondly, there is more pollution in urban areas, so more cases of AC are reported from urban areas. Thirdly, people are more aware in urban areas than their rural counterparts about their clinical condition, and pay visit to ophthalmologist.

AC may cause changes in corneal surface and thus cause refractive errors. There may be complications like secondary keratoconus, leading to astigmatism which eventually involves both eyes. In our study, 71.2% of study participants had first time consulted an ophthalmologist. Most of them had taken over the counter drugs by themselves or taken medicines from non-specialists. Among the rest of study participants i.e. 28.8% patients had taken treatment from some other hospital, but were not relieved of their symptoms, so they reported in OPD of our tertiary eye hospital. Similarly, in studies conducted by Kumah, *et al.* [17] and Palmares, *et al.* [18], majority of patients had started self-treatment.

In our study, itching was reported by 92.4%, frequent eye rubbing by 74.4%, redness by 72.4%, watery eyes by 78.8%, ropy discharge by 21.2% of patients. Almost similar percentages of symptoms in study participants were reported by Leonardi, *et al.* [11], and Kausar, *et al.* [14].

Main precipitating factors were dust, Sunlight, pollen, smoke, cosmetics and dandruff. Presence of a precipitating factor in SAC and PAC was statistically significant. Similar precipitating factors were found in studies by Leonardi, *et al.* [11], and Kosrirukvongs P, *et al.* [19]. In management of AC, it is very important to guide the patient to prevent exposure to precipitating factors. Patients reporting dust and sunlight as precipitating factors were advised to wear dark goggles. Patients with smoke, pollen as precipitating factors were advised to predominantly stay indoors when atmosphere outdoors was not suitable for them. Cosmetics like kajal or creams were to be avoided or changed to the ones that were non-allergic. Patients with dandruff as precipitating factor were advised dermatology consultation along with our treatment.

Out of total patients, majority of patients had symptoms since less than or equal to 4 weeks. Similar results were given by Leonardi, *et al.* [11]. Symptoms of AC are very disturbing for the patients as these interfere with their daily routine activities. So, there were more chances that patient will report to an ophthalmologist for treatment within few days of appearance of symptoms.

In our study, allergic rhinitis, dermatitis and asthma were reported by patients as associated condition. Leonardi, *et al.* [11] and Kausar, *et al.* [14] also- reported these three as associated atopic conditions. The findings noted in the present study suggest

a common pathogenesis for these allergic diseases. We, as ophthalmologists should be attentive for the presence of collateral atopic and rhinopharyngeal disease in patients with AC. This requires interprofessional management in AC cases.

In our study, irritability, loss of work or school days, decreased concentration were causes because of which AC affected patients' quality of life and this was significant in SAC patients. Similar results were given by Palmares, *et al.* [18] Kausar, *et al.* [14]. As AC affects mainly young population, loss of days at school or work and decreased concentration at work are very worrisome for patients and their families. This leads to economic losses if the affected person is a daily wagger. Decreased concentration and loss of days at school affect students' studies. Irritability due to itching of eyes and frequent eye rubbing leads to problems in their social and interpersonal relations.

In our study, conjunctival hyperaemia, tarsal conjunctival papillae, lacrimation and follicles were main signs on examination. Similar proportion of patients in a study conducted by Kausar, *et al.* [14].

Difference in number of patients prescribed monotherapy and polytherapy reporting improvement in signs was significant on 14<sup>th</sup> day and 1<sup>st</sup> month visit with more number of patients with polytherapy treatment showing improvement. At end of study period i.e. 6 months, this difference was not significant and all study participants showed improvement in signs.

In present study, topical steroids were the most used drugs in monotherapy as well as polytherapy treatments. It is because majority of patients had symptoms and signs which were managed by steroids only since steroids are very potent anti-inflammatory drugs. Other drugs used in treatment were topical dual-acting agents, topical immunomodulators, systemic antihistaminics, systemic NSAIDs, topical NSAIDs, topical vasoconstrictors. Similar drugs were given in study by Choi, *et al.* [20].

Compliance shown by patients on 3<sup>rd</sup> day, 7<sup>th</sup> day, 14<sup>th</sup> day, 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month visit was 99.6%, 97.6%, 87.6%, 64.4%, 41.6% and 19.6% respectively. According to review conducted by Koberlein, *et al.* [21], studies conducted across countries and addressing different diseases are consistent in estimating noncompliance between 30 and 50%.



Compliance, in this study, means adherence by the patient to guidelines given by ophthalmologist, that mainly includes visit to OPD for examination. This is very important because in AC, patient may be relieved of symptoms but signs do persist that lead to recurrence. This cycle continues and eventually leads to complications that may affect vision of patient. So, getting examined at regular intervals as advised by an ophthalmologist is very important in AC.

In AC, there usually occurs relief of symptoms though signs persist on examination. This stage is very crucial as patient feels that he/she is cured fully, but the persisting signs increase over time and may lead to vision threatening complications like shield ulcers, secondary keratoconus later. So, it becomes more important for patient to attend follow-up visits as advised by ophthalmologist. But in our study, some study participants did not adhere to this advise. Duration of therapy along with its expenditure was explained to all patients, still these were main causes for non-compliance. Covid-19 restrictions remained cause of non-compliance especially in the beginning of study period.

In this study, we came to know epidemiological factors associated with AC like age, gender, occupation, residence; symptoms and signs of AC, its managements and complications; along with its impact on quality of life of patients and compliance by patients for their own treatment. The ophthalmologist should ensure that ocular allergy patient has been thoroughly educated and provided with current prescriptions of the appropriate treatment. Dust and pollen count are expected to increase over the coming years due to climate change. It is very important to raise patient awareness of the sequelae of ocular allergies. Without treatment, individuals with ocular allergies may have to limit their daily routine activities such as reading and being outside. The overall goals for the treatment regimen in AC patient are improved patient care and quality of vision, with fewer signs and symptoms, fewer days away from school or work, resulting in a better overall quality of life.

### Limitations of Our Study

There are some limitations of this study as with any study. Firstly, there is absence of control group, with which precipitating factors, management of symptoms or side-effects could have been compared. Secondly, our hospital is located in urban area, so more

patients from urban areas might have been included in study, which may be a cause for statistical bias. Thirdly, using lubricating eyedrops as one of the drugs might have been an option as simple dilution of allergens may decrease signs and symptoms. However, our intention was to study effect of clinically available antiallergic drugs and we did not consider simple lubrication as management option for ethical reasons.

### Conclusion

An understanding of epidemiology of allergic conjunctivitis is essential as it involves certain modifiable and treatable environmental conditions. It can impair quality of life to varying degrees and some cases are quite refractory to treatment and may require multidisciplinary approach for management. Ophthalmologist should consider the probability of having allergic comorbidities in these patients to make diagnosis and treatment efficient and provide them a better quality of life.

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